MEMORANDUM

To: Ms. Debra Rossi, RPM (USEPA Region III)

From: Theresa Miller, PG, LSP (Golder)
Michele Ruth, PE (RAI)

Date: December 11, 2018

RE: Response to USEPA Request for Alternate Purging and Sampling Method for Long-Screen Wells
Army Creek Landfill Superfund Site, New Castle County, Delaware

On behalf of New Castle County (NCC) and the Army Creek Private Settlors (ACPS), Golder Associates Inc. (Golder) and Ruth Associates Inc. (RAI) prepared this response to the United States Environmental Protection Agency's (USEPA's) Comments 16 and 24 dated April 24, 2018 and subsequent correspondence (June 1, 2018 Response-to-Comments document by Golder and RAI) and discussions (July 25, 2018 teleconference and September 20, 2018 meeting) regarding long-screened wells and low flow sampling procedures for the Army Creek Landfill Superfund Site (Site) located in New Castle County, Delaware. This memorandum and attached table were prepared in response to these comments and discussions.

Low-flow purging and sampling techniques have been used historically for groundwater monitoring at the ACL and Delaware Sand & Gravel Superfund Sites. Many of the wells at and between these Sites have screens with filter packs longer than the recommended 10-foot-interval for low-flow sampling ("long-screen wells"). The USEPA has requested that volumetric averaging (3-well-volume purging followed by sample collection) be used in place of low-flow techniques.

Based on discussions between the USEPA and the Site representatives regarding the appropriate purging and sampling techniques for long-screen wells, the revised Additional Investigation Work Plan and Sampling and Analysis Plan (SAP) will include use of low-flow purging and sampling techniques consistent with historical practices combined with collection of a subset of samples using volumetric averaging (3-well-volume purging followed by sample collection). A table summarizing the construction of the wells in the monitoring program and the sampling methods is attached.

Selection of wells for comparison sampling using 3-well-volume purging were determined using the following criteria:

- Wells in key locations for conceptual site model (CSM) development with particularly long screens or potential significant heterogeneity within a long screen were targeted for comparison. These areas and wells include:
    - Western Lobe Study Area: P-4 and MW-22N
    - Screened across both UPA upper and lower sand: BW-3, MW-28, MW-29, and MW-31
    - PFAS Evaluation: MW-28, MW-29, MW-31 and MW-58
- Wells selected by DS&G for a similar volume averaging evaluation were not selected.

In addition, approximately two weeks prior to purging and sampling wells MW-28, MW-29, MW-31, and BW-3 (each of which is screened across both the Upper Potomac Aquifer [UPA] upper and lower sands), an electromagnetic flow-meter will be used to log the vertical flow within the wells and adjustments to proposed low-flow purging and sampling depths will be made, if necessary.

The following table summarizes the wells selected for comparison of the purging and sampling techniques and the rationale for selection:

Monitoring Point ID	Filter Pack Length (ft)	Screened Unit(s)	Rationale
MW-28	≥77	UPA - Upper and Lower Sand	These wells were selected because: 1) wells are screened across the UPA upper and lower sands (presence of Upper Potomac Dividing Clay [UPDC] is uncertain), 2) two depths are proposed for low-flow techniques to assess potential contaminant and concentration differences, 3) well filter packs are long, greater than 50 feet in length, and 4) wells are located immediately downgradient of the Eastern Lobe of the ACL.
MW-29	≥79	UPA - Upper and Lower Sand	
MW-31	≥57	UPA - Upper and Lower Sand	
BW-3	≤90	UPA - Upper and Lower Sand	This well was selected because: 1) well is screened across the UPA upper and lower sands (presence of UPDC is uncertain), 2) two depths are proposed for low-flow techniques to assess potential contaminant and concentration differences, 3) well filter pack is long, greater than 50 feet in length, and 4) well used to monitor downgradient compliance boundary for the ACL.
P-4	27	UPA - Upper Sand	This well was selected because: 1) well filter pack is 2 feet (greater than 10 feet) in length, and 2) elevated manganese concentrations have been observed in samples from this well over the last few years, resulting in the USEPA's requested Western Lobe investigation. Concentrations and trends in this well are important for conceptual Site model (CSM) development.
MW-22N	25	UPA - Lower Sand	This well was selected because: 1) well filter pack is 25 feet (greater than 10 feet) in length, 2) well appears to be screened within a confining unit (UPDC) and a gravelly portion of the UPA lower sand, and 3) well is located within the Western Lobe Study Area; and samples from this well have been non-detect and/or had low-level concentrations, thus concentrations and trends in this well are important to CSM development.

Monitoring Point ID	Filter Pack Length (ft)	Screened Unit(s)	Rationale
MW-58	≥35	UPA - Upper Sand	This well was selected because: 1) well filter pack is long, greater than 35 feet in length, 2) well is located upgradient of the ACL, and 3) two depths are proposed for low-flow techniques to assess potential contaminant and concentration differences within the upper sand for PFAS nature and extent evaluation.

The results of the sample analytical results from the different methodologies will be compared using a relative percent difference calculation, and the results will be included in semi-annual monitoring period covering the event in which the wells were sampled.

ATTACHMENT

Revised Table 2 - Monitoring Point Construction and Sampling Method Information
Revised Figure 2 – Proposed Western Lobe Monitoring Well Locations

Table 2
Monitoring Point Construction and Sampling Method Information
Army Creek Landfill Superfund Site
New Castle County, Delaware

Monitoring Point ID	Drilled Depth	Constructed Use	Inside Diameter (in)	Construction Material	Sounded Depth (ft-btoc)	Screened Interval (ft-bgs)	Screen Length (ft)	Filter Pack Interval (ft-bgs)	Filter Pack Material	Backfill Interval[2] (ft-bgs)	Backfill Material	Filter Pack Length (ft)	Screened Unit	Surface Completion	Purging and Sampling Method	Proposed Sampling Depth (ft-btoc)	Secondary Method for Comparison	Rationale for Comparison	Previous Sampling Depth (ft-bgs)	Sample Collection Purpose
MW-28	140	Former Extraction Well	6	Stainless Steel	111.6	43 - 120	77	No Record	No Record	120-130	No Record	≥77	UPA - Upper and Lower Sand	Standpipe	Submersible - low flow	50 and 90	yes - 3x purge	long screen and across UPA US and LS	50	N&E - PFAS
MW-29	130	Former Extraction Well	6	Stainless Steel	110.5	34 - 113	79	No Record	No Record	126-113	No Record	≥79	UPA - Upper and Lower Sand	Standpipe	Submersible - low flow	39 and 85	yes - 3x purge	long screen and across UPA US and LS	39	N&E - PFAS
MW-31	120	Former Extraction Well	6	Steel-PVC	112.1	59 - 116	57	No Record	No Record	116-120	No Record	≥57	UPA - Upper and Lower Sand	Standpipe	Submersible - low flow	75 and 95	yes - 3x purge	long screen and across UPA US and LS	75	N&E - PFAS
RW-10	102.5	Former Extraction Well	10	PVC	104	77 - 102	25	Unknown to 102.5	#2 Gravel	Not Applicable	Not Applicable	≥25.5	UPA - Upper Sand	Standpipe	Submersible - low flow	90	no	NA	90	N&E - Mn, Fe, Co, 1,2-DCA, PFAS
BW-1	126.5	Monitoring Well	4	PVC	132.9*	116.2 - 136.2*	20	111.2-136.7*	#2 Morie Sand	Not Applicable	Not Applicable	25.5	UPA - Lower Sand	Standpipe	Submersible - low flow	126	yes - perform by DS&G	NA	126	N&E - PFAS
BW-2	125	Monitoring Well	4	PVC	142.9*	123 - 143*	20	118-143*	#2 Morie Sand	143-144*	Not Specified	≤26	UPA - Lower Sand	Standpipe	Submersible - low flow	133	yes - perform by DS&G	NA	133	N&E - PFAS
BW-3	135	Monitoring Well	4	PVC	125	50 - 135	85	47-135	#2 Morie Sand	135-137	Not Specified	≤90	UPA - Upper and Lower Sand	Standpipe	Submersible - low flow	55 and 92	yes - 3x purge	long screen and across UPA US and LS	92	N&E - PFAS
MW-40	152	Monitoring Well	4	PVC	142.1	110 - 140	30	No Record	No Record	140-152	No Record	≥30	UPA - Lower Sand	Standpipe	Submersible - low flow	125	no	NA	125	N&E - PFAS
P-4	137	Monitoring Well	2	PVC	124.9	115 - 125	10	108-135	Sand	125-135	Sand	27	UPA - Upper Sand	Flush mount	Submersible - low flow	120	yes - 3x purge	screen length and in Study Area	120	N&E - Mn, Fe, Co, 1,2-DCA, PFAS
P-4L	DNE	Monitoring Well (proposed)	2 (proposed)	PVC (proposed)	TBD	TBD	≤ 8 (proposed)	TBD	#2 Sand (proposed)	TBD	Grout (proposed)	≤10 (proposed)	UPA - Lower Sand (proposed)	Flush mount (proposed)	Submersible - low flow	TBD	no	NA	NA	N&E - Mn, Fe, Co, 1,2-DCA, PFAS
WL-1U	DNE	Monitoring Well (proposed)	2 (proposed)	PVC (proposed)	TBD	TBD	≤ 8 (proposed)	TBD	#2 Sand (proposed)	TBD	Grout (proposed)	≤10 (proposed)	UPA - Upper Sand (proposed)	Standpipe (proposed)	Submersible - low flow	TBD	no	NA	NA	N&E - Mn, Fe, Co, 1,2-DCA, PFAS
WL-1L	DNE	Monitoring Well (proposed)	2 (proposed)	PVC (proposed)	TBD	TBD	≤ 8 (proposed)	TBD	#2 Sand (proposed)	TBD	Grout (proposed)	≤10 (proposed)	UPA - Lower Sand (proposed)	Standpipe (proposed)	Submersible - low flow	TBD	no	NA	NA	N&E - Mn, Fe, Co, 1,2-DCA, PFAS
WL-2U	DNE	Monitoring Well (proposed)	2 (proposed)	PVC (proposed)	TBD	TBD	≤ 8 (proposed)	TBD	#2 Sand (proposed)	TBD	Grout (proposed)	≤10 (proposed)	UPA - Upper Sand (proposed)	Standpipe (proposed)	Submersible - low flow	TBD	no	NA	NA	N&E - Mn, Fe, Co, 1,2-DCA, PFAS
WL-2L	DNE	Monitoring Well (proposed)	2 (proposed)	PVC (proposed)	TBD	TBD	≤ 8 (proposed)	TBD	#2 Sand (proposed)	TBD	Grout (proposed)	≤10 (proposed)	UPA - Lower Sand (proposed)	Standpipe (proposed)	Submersible - low flow	TBD	no	NA	NA	N&E - Mn, Fe, Co, 1,2-DCA, PFAS
MW-22N	159	Monitoring Well	4	PVC	159.18	139 - 159	20	134-159	#2 Morie Sand	Not Applicable	Not Applicable	25	UPA - Lower Sand	Flush mount	Submersible - low flow	149	yes - 3x purge	screen length and in Study Area	149	N&E - Mn, Fe, Co, 1,2-DCA, PFAS
MW-22NU	DNE	Monitoring Well (proposed)	2 (proposed)	PVC (proposed)	TBD	TBD	≤ 8 (proposed)	TBD	#2 Sand (proposed)	TBD	Grout (proposed)	≤10 (proposed)	UPA - Upper Sand (proposed)	Flush mount (proposed)	Submersible - low flow	TBD	no	NA	NA	N&E - Mn, Fe, Co, 1,2-DCA, PFAS
MW-54	131	Monitoring Well	4 (assumed)	PVC (assumed)	unknown	40 - 50	10	No Record	No Record	No Record	No Record	No Record	UPA - Upper Sand	Standpipe	Submersible - low flow	TBD - no log	no	NA	NA	N&E - PFAS
MW-56	105	Monitoring Well	4	PVC	unknown	75 - 100	25	No Record	No Record	100-105	No Record	≥25	UPA - Upper Sand	Standpipe	Submersible - low flow	85	no	NA	NA	N&E - PFAS
MW-58	118	Monitoring Well	4	PVC	unknown	65 - 110	35	No Record	No Record	110-118	No Record	≥35	UPA - Upper Sand	Standpipe	Submersible - low flow	75 and 95	yes - 3x purge	long screen and upgradient location	NA	N&E - PFAS
GV-1	unk	Former Gas Vent	4	PVC	23.59	unknown	unknown	unknown	unknown	unknown	unknown	unknown	Landfilled material	Standpipe	Bailer - 3x purge	NA	NA	NA	NA	N&E - PFAS
GV-7	unk	Former Gas Vent	4	PVC	27.3	unknown	unknown	unknown	unknown	unknown	unknown	unknown	Landfilled material	Standpipe	Bailer - 3x purge	NA	NA	NA	NA	N&E - PFAS
GV-9	unk	Former Gas Vent	4	PVC	19.94	unknown	unknown	unknown	unknown	unknown	unknown	unknown	Landfilled material	Standpipe	Bailer - 3x purge	NA	NA	NA	NA	N&E - PFAS
GV-13	unk	Former Gas Vent	4	PVC	22.3	unknown	unknown	unknown	unknown	unknown	unknown	unknown	Landfilled material	Standpipe	Bailer - 3x purge	NA	NA	NA	NA	N&E - PFAS
GV-14	unk	Former Gas Vent	4	PVC	25.77	unknown	unknown	unknown	unknown	unknown	unknown	unknown	Landfilled material	Standpipe	Bailer - 3x purge	NA	NA	NA	NA	N&E - PFAS
GV-17	unk	Former Gas Vent	4	PVC	23.8	unknown	unknown	unknown	unknown	unknown	unknown	unknown	Landfilled material	Standpipe	Bailer - 3x purge	NA	NA	NA	NA	N&E - PFAS
GV-29	unk	Former Gas Vent	4	PVC	24.65	unknown	unknown	unknown	unknown	unknown	unknown	unknown	Landfilled material	Standpipe	Bailer - 3x purge	NA	NA	NA	NA	N&E - PFAS
GV-46	unk	Former Gas Vent	4	PVC	25.77	unknown	unknown	unknown	unknown	unknown	unknown	unknown	Landfilled material	Standpipe	Bailer - 3x purge	NA	NA	NA	NA	N&E - PFAS
GV-48	unk	Former Gas Vent	4	PVC	31.9	unknown	unknown	unknown	unknown	unknown	unknown	unknown	Landfilled material	Standpipe	Bailer - 3x purge	NA	NA	NA	NA	N&E - PFAS
GV-51	unk	Former Gas Vent	4	PVC	29	unknown	unknown	unknown	unknown	unknown	unknown	unknown	Landfilled material	Standpipe	Bailer - 3x purge	NA	NA	NA	NA	N&E - PFAS
AWC-2	164	Production well	10	Concrete	125.95	131-156	25	Not Specified	Not Specified	154-164	Very Fine to Coarse Gravel	≥33	UPA - Lower Sand	Concrete vault	Draw from sample collection port when well is operating	NA	NA	NA	NA	Risk and N&E - Mn, Fe, Co, 1,2-DCA, PFAS
AWC-G3R	162	Production well	12	Stainless Steel	not available	102-157	55	98-157	#2 Well Gravel	157-162	Not Specified	≥64	UPA - Upper and Lower Sand	Standpipe	Draw from sample collection port when well is operating	NA	NA	NA	NA	Risk and N&E - Mn, Fe, Co, 1,2-DCA, PFAS
AWC-6R	170	Production well	12	Stainless Steel	not available	105-145	40	100-145	#2 Gravel	Not Specified	Not Specified	≥40	UPA - Upper and Lower Sand	Standpipe	Draw from sample collection port when well is operating	NA	NA	NA	NA	Risk and N&E - Mn, Fe, Co, 1,2-DCA, PFAS
AWC-7	180	Production well	12	Stainless Steel	136.02	115-175	60	Not Specified	Not Specified	175-180	Not Specified	≥65	UPA - Upper and Lower Sand	Standpipe	Draw from sample collection port when well is operating	NA	NA	NA	NA	Risk and N&E - Mn, Fe, Co, 1,2-DCA, PFAS

Notes:

1.) Information compiled from water level monitoring purge forms between 2012 and 2018 and historic boring logs.
2.) ft-bgs = feet below ground surface
3.) ft-btoc = feet below top of casing
4.) ft-msl = feet mean sea level
5.) in = inches
6.) NA = not applicable
7.) PVC = polyvinyl chloride
8.) TBD = to be betermined
9.) TOC = top of casing
10.) UPA = Upper Potomac Aquifer
11.) "No Record" indicates monitoring well construction log was not found or was not created at the time of well installation.
12.) "Not Specified" indicates monitoring well construction log did not include the indicated information.
13.) unk = unknown
14.) * indicates different from monitoring well construction log due to extention of well by New Castle County in Reforestation Area
15.) N&E = nature and extent

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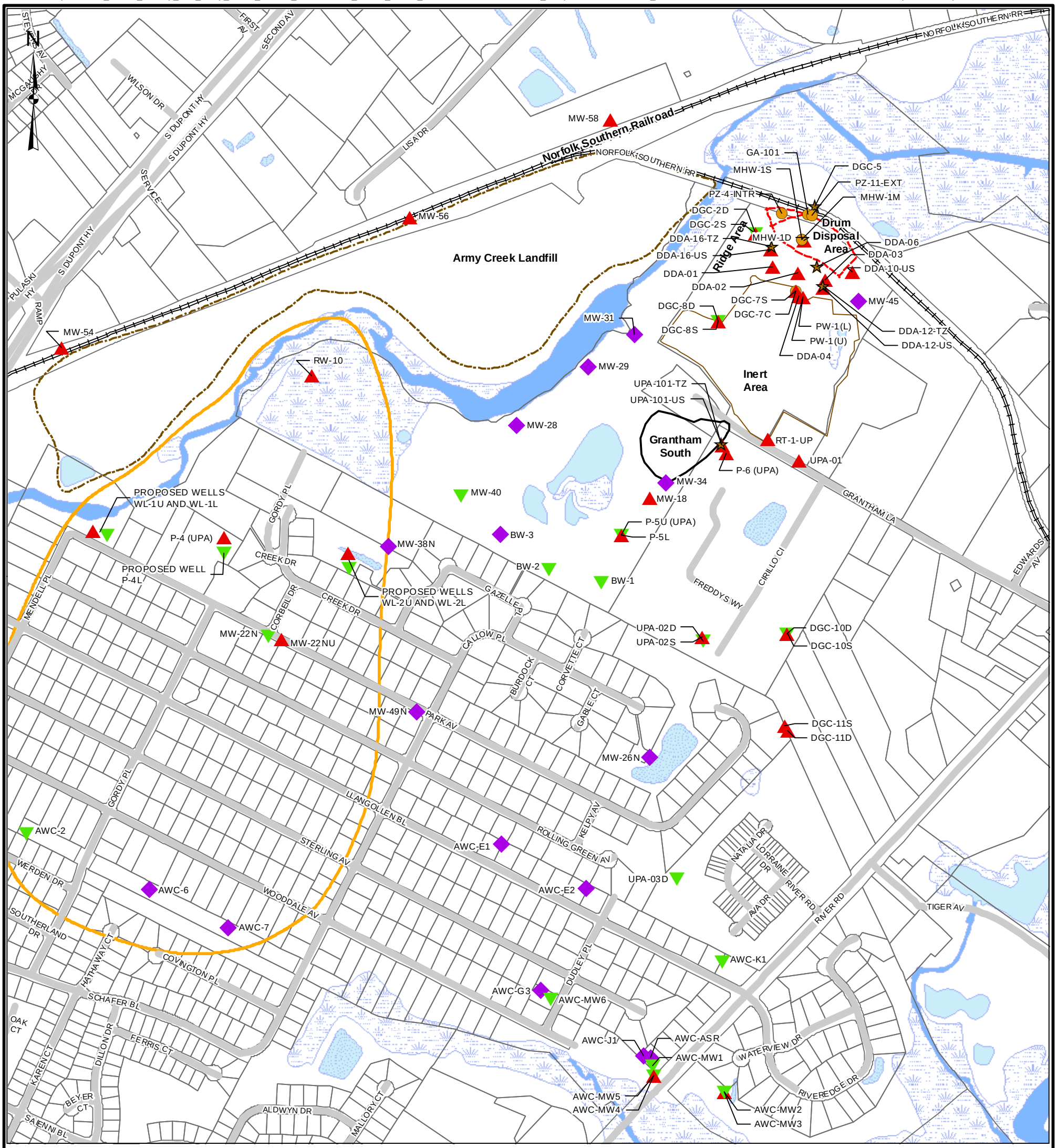

LEGEND

- Well screened in UPCU Transition Zone
- Well screened in UPA Upper Sand
- Well screened in UPA Lower Sand
- Well screened across UPA Upper Sand and Lower Sand
- Well screened in Columbia Aquifer
- Western Lobe Study Boundary

REFERENCE

Base data from New Castle County Delaware, Department of Land Use, "eParcel View Map" web site GIS data download. Data acquired 01/18/2012.

0 300 600 1,200 Feet

FIGURE 2

REVIEW		
CHECK		
GIS	AM	12/11/2018
DESIGN	BAR	12/11/2018
REV. 0	SCALE: AS SHOWN	
FILE No.	1899295-0001-004	
PROJECT No.	013-6052.007	

TITLE

PROPOSED WESTERN LOBE MONITORING WELL LOCATIONS

PROJECT

Army Creek Landfill Superfund Site
New Castle, Delaware

GOLDER